Misrita-Nava-Dharmámnáyáh.

4. 2. 1. 3. 5.
Pándará. Lochaná. Vajradhátwiswarí. Mámakí. Tárá.
8. 6. 7. 9.
Pratyangirá. Vajrasatwátmiká. Vasundhará. Guhyeswarí.

Mánushíya-Nava-Buddhámnáyáh.

4. 2. 1. 3. 5.
Sikhí Ratnagarbha. Dípankara. Vipasyí. Viswabhú.
8. 6. 7. 9.
Kásyapa. Kakutsanda. Kanakamuni. Sákyasinha.

Mánushíyá-Nava-Buddhámnáyáh.

1. 2. 3. 4. 5.
Dípankara. Ratnagarbha. Vipasyí. Sikhí. Viswabhú.
6. 7. 8. 9.
Kakutsanda. Kanakamuni. Kásyapa. Sákyasinha.

Mánushíya-Nava-Prajnámnáyí.

1. 2. 3. 4. 5.
Jwálávatí. Lakshanavatí. Vipasyantí. Sikhámáliní. Viswadhará.
6. 7. 8. 9.
Kakudvatí.. Kanthanamáliní. Mahídhará. Yasodhará.

Nava Bhikshu-Sanghámnáyáh.

1. 2. 3. 4. 5.
Pradipeswara. Ratnarája. Mahámati. Ratnadhará. A'kásaganja.
6. 7. 8. 9.
Sakalamangala. Kanakarája. Dharmodara. Ananda.

Iti Srí-Ekámnáyádi-Navámnáya-Devatáh Samáptáh.

N. B. The authority for these details is the Dharma Sangraha, or *catalogue raisonné* of the terminology of Bauddha system of philosophy and religion.

III.—*Notes explanatory of a Collection of Geological Specimens from the Country between Hyderabad and Nágpur. By* J. G. Malcolmson, *Assistant Surgeon, Madras Establishment. Pl. V.*

I had the pleasure of forwarding from Madras, a selection of geological specimens, collected in May, 1833, between the cities of Hyderabad and Nágpur. I regret, that circumstances prevented my doing this sooner, and that the notes in explanation of the localities whence they were obtained, must now be short and imperfect; I hope, however, that the specimens themselves will be of use in illustrating the geology of a tract of country hitherto undescribed, and which connects the formations of the south-east of the Deccan, with those in the neighbourhood of the valley of the Narbada.

From my inability to identify, describe, and figure the numerous fossils, discovered in the tract of country between the Godavery and the town of Hinganghát, 47 miles south of Nágpur, and the importance of these, in reference to the questions as to the relative age of the great trap formation of the Deccan, and of the west of India, and the clayslate formation of Voysey, with its associated sandstone*, and the periods of elevation of the granitic rocks, on which

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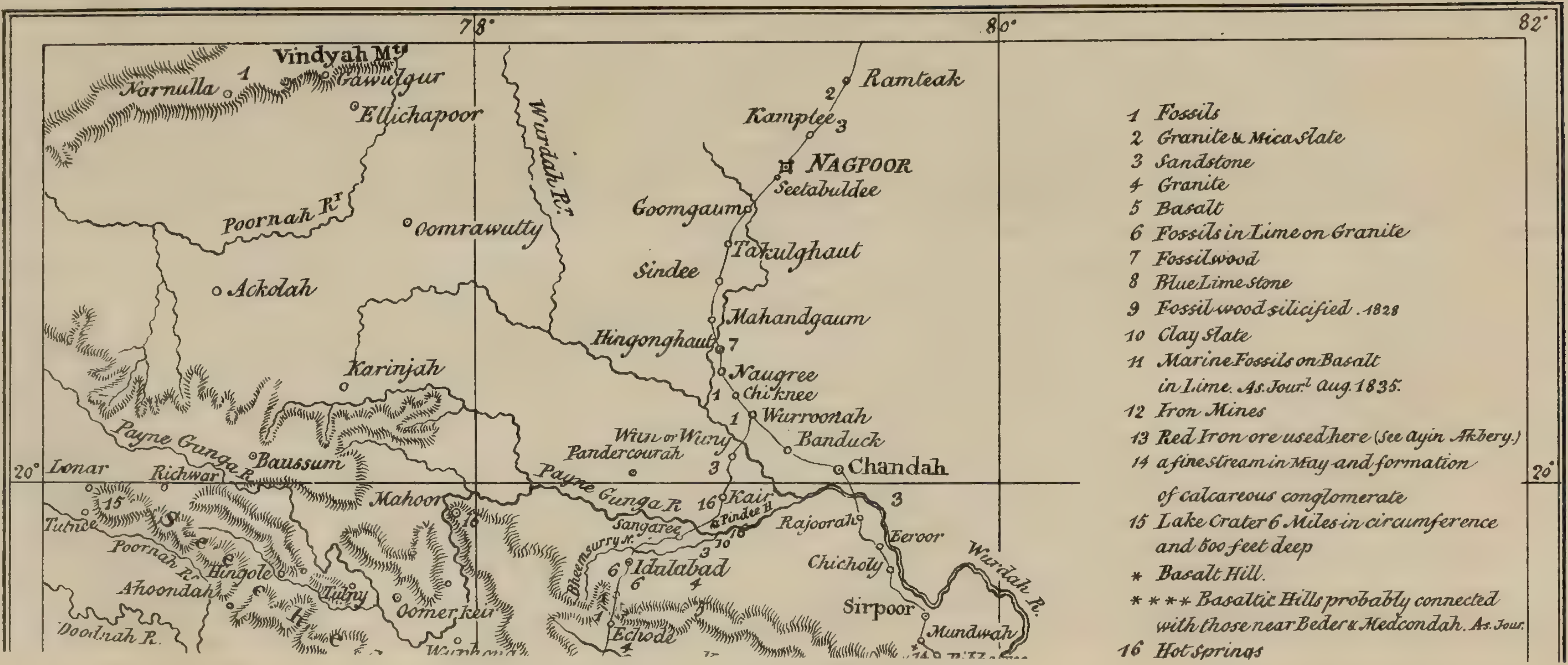
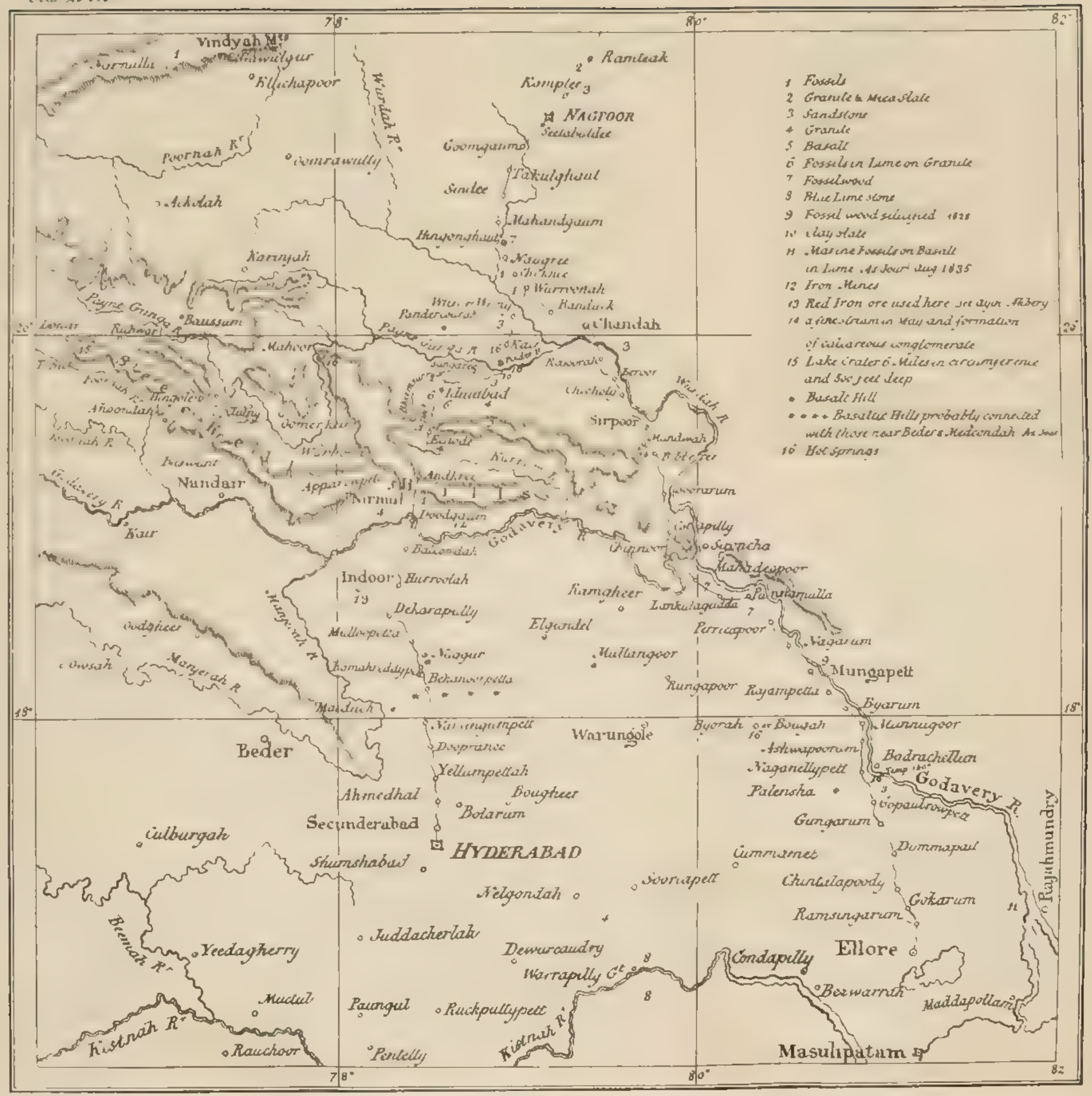
* See his account of the diamond mines of Banganapilly.—As. Res. xviii.


78°
80°
82°
20°
20°
Vindyah Mts
Narnulla
Gawulgur
Ellichapoor
Wurdah R.
Poornah R.
Oomrawutty
Ackolah
Karinjah
Payne Gunga R.
Baussum
Lonar
Richwar
Mahoor
Tutnee
Poornah R.
Hingole
Ahoondah
Tulny
Oomer keir
Doodnah R.
Ramteak
Kamptee
NAGPOOR
Seetabuldee
Goomgaum
Takulghaut
Sindee
Mahandgaum
Hingonghaut
Naugree
Chiknee
Wurroonah
Win or Winy
Pandercourah
Banduck
Chandah
Payne Gunga R.
Kair
Pindee H.
Sangaree
Bheemsurry N.
Rajoorah
Eeroor
Chicholy
Idalabad
Sirpoor
Echode
Mundwah
Wurdah R.
1 Fossils
2 Granite & Mica Slate
3 Sandstone
4 Granite
5 Basalt
6 Fossils in Lime on Granite
7 Fossilwood
8 Blue Lime stone
9 Fossil wood silicified . 1828
10 Clay Slate
11 Marine Fossils on Basalt in Lime. As. Jourl. Aug. 1835.
12 Iron Mines
13 Red Iron ore used here (See Ayin Akbery.)
14 a fine stream in May and formation of calcareous conglomerate
15 Lake Crater 6 Miles in circumference and 500 feet deep
* Basalt Hill.
* * * * Basaltic Hills probably connected with those near Beder & Medcondah. As. Jour.
16 Hot Springs



J B Tassin's Lith^c Press Calcutta

they appear universally to rest; I am induced, contrary to my former intention, to take to England with me, those specimens of which there are no duplicates. The separation of the collection would greatly lessen its value, by depriving me of the opportunity of comparing, with each other, and with arranged collections, the fragments of those of which duplicates were not preserved, and of thus restoring the fossils of which no perfect specimen was found. A selection of the most perfect were, also, sent to Mr. Lyell, but as he considers it requisite that numerous species should be ascertained previous to arriving at any conclusion as to the age of the fossiliferous rocks, it may be for the advantage of Indian geology, to submit the rest of the specimens to him; and on the characters being determined, to return a portion of them to India. There are, however, a sufficient number of duplicates to illustrate the outlines of the geology of the interesting tract of country referred to, and to connect the singular phenomena observed, with others, to the west and east of the route, and in the countries of the peninsula to the south, and the Bengal provinces to the north. The outline map includes several places, inserted in the plans published along with Dr. Voysey's papers and Captain Jenkin's Account of the Mineralogy of Nágpur, p. 199, of the 18th volume of the Asiatic Researches; the interval between which, it will assist in filling up. I shall seldom use mineralogical terms, except I have had an opportunity of comparing the specimens with those collected by persons well acquainted with the science; and when they do occur, an examination of the specimens will afford the means of correcting any errors that may be fallen into. The geological relations of the strata were ascertained with as much care as the nature of the country permitted, and no exertion was spared in tracing them as far as possible, both on the plains, at the foot of the hills, and their most inaccessible summits. My avocations however were unfavourable, and a person more at leisure would find an ample field to reward his labours. He must, however, be prepared to pursue his examinations in the height of the hot season, when the grass and wood jungle are less luxuriant, and the plains free from their covering of *jawárí* and other grain.

Some account has already been published* of the country between Masulipatam and Hyderabad, on which I had not an opportunity of making many observations. One or two points, however, deserve to be noticed, as the specimens collected in this part of the route are similar to those found north of Hyderabad as far as Nírmal, and throw some light on appearances on which important inferences have been too hastily founded.

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* Asiatic Researches, vol. xviii.

At page 70, volume ii. of the GLEANINGS IN SCIENCE, a desire is expressed by a gentleman at home, stated to be of high scientific acquirements, that specimens should be collected from the face of the hill of Beirwarah, where it has been cut through by the *Kistnah* river; and the author of the queries seems to be impressed with a belief, that a lake had formerly existed some way above it, towards Warapilly. The distance, however, between the Warapilly ghat and Beirwarah, is considerable; and I do not think, that there are any decided appearances at the former of the blue limestone of the clay-slate formation* having constituted the margin of a lake. The strata at the upper part of the rising ground to the north of the river are as hard as those lower in the valley, or on the opposite bank. A specimen of this rock, of a pure white color, and of great hardness, which I broke from the summit of the ascent above Warapilly, well known to travellers from the difficulty of riding over the large smooth slabs of marble, and which would have been admirably adapted for lithographic purposes, had it been free from minute crystals of quartz, was sent to you about three years ago by Captain SMITH of the Madras Engineers. The junction of this rock with the granite to the north, could not be seen, the country being flat, and covered with low jungle. Jaspers and fragments of trap are found in the bed of the river, and the granite to the north is intersected by numerous dykes of greenstone, usually running from S. E. by E. to N. W. by W. To the south of the river, the country is lower, and for some way beyond the town of Dachapilly, the limestone, usually dipping slightly to the south, continues to be the surface rock; which, whenever I have met with it, on the Kistnah, at Cuddapah, near Auk, and the diamond mines of Banganapilly, and at Tarputrí in Bellary, or in the neighbourhood of the Wurdah, affords the best indications of success to experiments in boring; copious springs spontaneously rising from it, or being lost in the interstices between its nearly horizontal strata.

At Beirwarah, the river Kistnah appears to have cut a channel through the short ridge of hills, which terminates on either side in rather precipitous cliffs, and admits the stream into the great alluvial plains extending to the mouths of the Kistnah and Godavery. Above, the country has much the appearance of having once been an extensive lake, the bottom of which now forms the rich plain extending to Condapilly to the N. W., and Munglegherry to the south of the river. It is probably here, that Captain Herbert's correspondent observed that the "hardness and composition of the rock appeared to differ, according to the pressure they have been subjected to." I believe, that, specimens of the rocks of the bottom of the hill, have been sent to the Asiatic Society by Dr. Benza, and that they are composed of the peculiar gneiss of the coast. Felspar is common, and some of the varieties possess considerable beauty. There are the remains of a rock pagoda cut in a mass of compact felspar, above the road, leading along the edge of the precipice over the river, portions of which have fallen, the natural fissures of the rock exposing it to this kind of decay. On the top of the hill the soft friable white rock, No. 2*, is found, and is carried away by the natives for the purpose of whitening the walls of their houses. It corresponds exactly with specimens from Vizagapatam, described as gneiss by Heyne, and containing imperfect garnets. It is not, however, either its site as lying above other rocks, or its exposed situation, that has led to its decay, so much as the composition of the ridge where the edges of the strata rise to the south. The strata dip at a very considerable angle a little to the south of east. A careful survey of the hills from the summit shows, that they are short insulated ranges, such as are found over the Circars and other tracts, rising from a level country; and that had a lake existed in the plain above, every slight rise of the river would have carried its waters round their shoulders to the north and south. The rise in the line of bearing of the strata of the hill north of the river, and the appearance of that to the south, do not support the opinion that the lake was drained by the river deepening its channel. I do not know whether it can be supposed to derive any support from a tale told of the river god (*Krishna*) having induced the patron of the hill, who seems to be a form of *Shiva*, to permit him to get his head through, and that then he forced a passage. The granitic hills of Condapilly are seen a few miles to the N. W.; and in the midst of the plain, rising out of it like an island, are some great masses of hornblende rock, No. 6; and Dr. Benza informs me that he saw dykes of the same kind of greenstone passing through the gneiss at Beirwarah. A mile and a half further on the road to Hyderabad is a quarry of granitic rock, devoid of hornblende, and containing only a very little felspar and a few scattered garnets. A little beyond this, the rocks assume the decided characters of the great granite formation of the Deccan, with which Dr. Voysey's papers have made your readers acquainted. The geological structure of the Circars is in nothing so peculiar, as in the extensive distribution of the singular sandstone-like gneiss described by HEYNE; and which, in hand specimens, it is often impossible to distinguish from the sandstone also found in many localities: and I do not know a more interesting subject of inquiry, than that of ascertaining whether this singular rock is metamorphic, and the sandstone altered by the intrusion of the great masses of porphyry so commonly found near these equivocal rocks, and by the numerous greenstone dykes and masses scattered over the whole of these districts. The diamond mines of Mulavelly are at no great distance from Condapilly, to the right of the road, situated in a basin between hills covered with jungle. The sides of which, one-third from the top, were found by Dr. W. DAVIDSON to be strewed with a sandstone conglomerate; but he was prevented getting to the top by the approach of night. Fragments of this are found in the gravel, of which I believe specimens have already been sent to the Society, intermixed with much kankar: and from some pits in the valley, most of the lime used in the district is procured. The soil of the country on the Hyderabad Military road, after leaving the alluvial plain above Beirwarah, is formed of decomposed granite, but contains much lime. This admixture, and the kankar nodules, are probably of recent origin; as I observed, in a valley to the right of the road north of the hill fort of Yeralagundah, about 18 miles from Beirwarah, a stream trickling over granite rocks, and depositing lime on all the branches and rocks around. Some pieces of stone of considerable size have thus been formed, and recent specimens, containing remains of branches, or of grass, easily crumble to pieces, and are carried away by the stream. The source of the spring I was prevented from ascertaining, by the approach of night; and as an excuse for leaving this and other interesting circumstances unexplored, I must state, that being in Medical charge of the European regiment, during a sickly season, I could not command my own time of marching, or sufficient leisure.

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* I use this term of Dr. VOYSEY, but think its adoption more objectionable than argillaceous limestone, used by Colonel CULLEN in the Madras Transactions. It would be better to characterise it as "blue limestone," "Cuddapah limestone," or other term involving no opinion as to its geological relations.

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* The numbers refer to specimens deposited in the Society's Cabinet.—Ed.

The character of the granite of the Deccan continues well marked throughout the remaining part of the route to Hyderabad, and dykes and imbedded masses of a fine crystalline greenstone or hornblende rock of great hardness are frequently seen. These last have occasionally irregular shapes, and in one or two instances, that of the italic or other irregular curve; and near Secunderabad, they appear to be connected with the dykes, in the neighbourhood of which they are found. It was also frequently observed, that the various substances entering into the composition of the granite in the neighbourhood of these dykes or masses, formed very large and distinct crystals; and the imbedded greenstone, though often intimately united with the granite, was in others more loosely connected, and easily separated by the progress of decomposition, leaving rounded cavities in the rock.

A circumstance of more importance, however, is the occurrence of the beds of kankar in this tract, being, as far as I have observed, always near some of the greenstone dykes or beds, and frequently under or intermingled with masses of granite, which is in a rapid state of decay: these are usually rounded, partly from the progress of decomposition, and sometimes from the tendency to concentric forms, which it occasionally undoubtedly assumes. The small detritus is in some places accumulated to a great depth, and it has been stated by Dr. Christie, that this debris is, at a considerable depth, again consolidated by pressure. In the Edinburgh Journal of Science, 1828-29, this is also mentioned as a fact, common to the rocks of other parts of India. With every respect for his authority, I cannot avoid the conviction, that the inference was founded on imperfect observation, and that it has since been employed in Europe, in support of an ill-founded theory.

No. 15, is " Mhurrum" or gravel found in deepening a well at Bolaram, (six miles from Secunderabad,) upwards of 50 feet deep, during the very dry season of 1832, and is not in the slightest degree consolidated. A loose block, which had resisted decomposition, was found above it, and contains mica, (No. 15,) a rare ingredient in the granite of Hyderabad. Much of the debris at Secunderabad is, however, consolidated by lime, which is seen to agglutinate the fragments, or to pass in vein-like lines or nodules through the gravel. Occasionally there are only a few fragments of quartz or felspar scattered through the kankar, or they appear to be inserted into the surface, as in No. 10, which is extremely hard. Generally, however, the agglutinated gravel is friable, and the cement less obvious. The debris is also sometimes united into pulverulent masses, by the oxidation of the iron contained in the sienite; but this takes place at the surface, and seldom acquires any great degree of hardness. Specimens of the granite in the neighbourhood of Hyderabad are numbered 14; and the appearance of the surface of that polished by the continual passage of hyenas, in the entrance of the caverns formed in the pile of gneiss or granite of the " Chítá hill," near the cantonment, has been described in the 1st volume of the Journal of the Asiatic Society, (No. 12.) The greenstone occasionally has distinct crystals of felspar scattered through it, without the porphyry thus formed, losing the remarkable degree of toughness possessed by the black rock; but, as observed by Sir H. Davy, the decomposition of the felspar is more rapid than of the other parts, (No. 19.) The greenstone is familiarly known by the name of "black granite," and forms, when finely polished, the beautiful tombstones of the Golconda mausoleums, and the pillars of that in which Hyder and Tippu Sultan are deposited, at Seringapatam. The remarkable quartz veins in the neighbourhood of Hyderabad have been described by Voysey and Christie; it is therefore only necessary to mention, that they occasionally exhibit a more or less regular crystallization, and at the same time, acquire the fine tints of the amethyst. It is seldom that they are sufficiently regular and perfect for the purposes of the lapidary; such specimens were, however, discovered a few years ago, close to the European barracks, and at a little distance from a great greenstone dyke, but not in direct contact with the quartz bed containing the crystals, which, on the contrary, passes into the ordinary sienitic granite of the country. The colour of the amethystine quartz seems to be derived from magnetic iron ore, which is disseminated in grains both through the milky quartz and the granite, amongst which they are found, and has not been noticed elsewhere in the neighbourhood. The amethystine quartz was again met with 60 miles north of Secunderabad, near Bekanúrpettah, in loose masses, along with that variety of laterite found near Beder, and described by Voysey, and which is seen along the coasts of Malabar and at Boranghur in the Southern Concan resting on basalt. The rising ground on which they were found is composed of granite; but the country around is of a black trap soil, and numerous low flat ranges of basaltic hills are seen to the north, the east, and the west. A vein of white quartz is also met with as at Secunderabad, but the specimens differ, in containing irregular shaped geodes of agate, lined with crystals, or a red opake mamillary quartz, approaching to calcedony. The iron in these is usually imperfectly mixed with the quartz, and from the appearances above described, and the quartz having in several specimens been changed into a red jasper, the surrounding trap may be supposed to have altered the rocks. The colouring matter seems to have been afforded by the laterite, which is found in the neighbourhood apparently in dykes, and in contact with the quartz which intersects the granite: but there being no section, and the water-worn surface only being visible, no evidence could here be obtained, in support of any of the opinions entertained by geologists, relative to this singular formation. The amethysts are also found south of Janganapilly, and at Kamareddypettah, and Mr. W. Geddes met with them, of a greenish yellow tinge, south of Balcondah.

Granite Tract between Hyderabad and the Nírmul Hills.

The valleys and some plains about Bekanúrpettah are composed of black soil, mixed with calcedonies, &c.; and to the west of the road are some flat hills, which I had not an opportunity of examining. They corresponded in their steep sides and flat summits with the trap hills to be presently described, and Mr. GEDDES informed me, that they are formed of amygdaloidal trap, based on decaying granite. With these interruptions, the granite continues to Kamareddypettah, but the mamillary eminences, and the tors and logging stones formed from their decomposition, are of more rare occurrence. The granite, however, still continues to exhibit the lamellar structure, and is easily split into large slabs. In some instances, where the lamellæ are thin, the vertical fissures which frequently intersect them in right lines, and greatly assist the progress of decomposition, cause the rock to break into regular rhomboids. The last "tor stones" observed on the road to Nágpur were north of Jakrampilly, where they occurred on a lofty hill, on which there is a small pagoda. After leaving the basaltic hills near Bekanúrpettah and Jungampilly, black soil is seen in the valley below a large tank, and some dykes of greenstone pass the road in the direction of S. by E. to N. by W. at Kamareddypettah: the granite is lamellar white, with black mica and some hornblende, and fragments of amethystine quartz are scattered about. A little to the north of the town, on ascending a very gentle ascent, the red soil and granite give way to black soil, derived from decomposed trap rock, which is concentric on the top, but lower down is arranged in imperfect strata. On descending the hill to the north, the black soil conceals the granite for a short distance; but at the bottom of the hill, and in the bed of a small water-course, it is seen of the same appearance as before. Immediately beyond this, there is a very remarkable hill, which is seen from a considerable distance standing out from the gently indulating country, and possessing the peculiar form of the trap hills of the Deccan. It lies five miles north of Kamareddypettah, and four miles south of the village of Nugger, and is marked on the specimens as the "hill of Nugger." On approaching it by a very gradual ascent, the soil changes to black; and all at once the hill rises with nearly perpendicular sides, constituting a narrow ridge, about half a mile in length, and of a shape approaching to that of an Italic *ſ* running nearly N. by E. to S. by W. The hill is entirely formed of basalt, as its form had led me to expect. Above and in the body of the hill it has a concentric globular structure, the external layers of which are remarkably soft, and on the top of the hill resemble a peperino; lower down it is soft, of a greenish color, and soapy feel, (Nos. 66 and 69.) The nuclei left undecayed on the top, are exceedingly hard and tough, of a deep black colour, and contain large crystals of olivine, and small globules of calcedony. Many small but very characteristic specimens of this last mentioned mineral, which had been imbedded between the concentric nodules, were picked up (No. 67). At the bottom of the hill, the basalt loses its concentric form, and occurs in tables or laminæ, having the appearance of having been subjected to violent forces. It sounds under the hammer when struck. Various specimens of the trap are much loaded with iron, sometimes in grains of a reddish brown colour; at others, it appears as if it had been partially smelted, and is not very different in its appearance from some examples of laterite. Much of the "kankar" that abounds in the soil is coloured with iron, while other portions are perfectly white; it is not, however, confined to the soil, as it was observed to have formed between two laminæ of the basalt, and by the gradual deposition of the lime, to have nearly broken up the upper stratum. From between some of the vertical fissures in the tables, and round the large rounded masses that occur in them, a formation of "kankar" projects in several places half a foot from the surface of the rock. It was evident, that the water loaded with lime, percolating through the alluvial black soil, or through the rock itself, gradually deposits the earth, where its accumulation is favoured by circumstances, of which the most important is the occurrence of an impervious rock or soil below that supplying the lime; and this explains the absence of organic remains in this recent formation, except where, in soils rich in lime, it forms round the roots of plants, and unites with itself, here and there, a fresh-water shell. No. 47, is a specimen illustrative of these views, taken from the south bank of the Godavery. The rock over which the river flows is granite, intersected by some great dykes of greenstone, (No. 44,) whose surface has a smooth metallic coating where washed by the stream. They project eight or ten feet, and are divided into numerous rhomboidal masses by fissures, into which lime has been deposited; and in the bed of the river, numerous fragments of calcedonies, zeolites, and other minerals found in volcanic rocks, are partially cemented by lime. The banks are mostly composed of black cotton soil, and the lower part is covered with small irregular loose slabs, resembling the dried cow-dung used for fire; which are found in sitù projecting from the bank, and connected above with portions formed round the roots of plants, and below with other layers spread out between different strata of the alluvial earth.

From the top of the hill of Nugger above spoken of, numerous insulated hills, and short ranges of a similar form, are seen to rise from the granitic tract to the east and west, but they do not observe any particular line of bearing, although the whole group seems to pass in a direction from east to west, like the other basalt ranges of the table land. From this hill to four or five miles north of Nírmul (a large town nine miles north of the Godavery) as in almost all other parts of the peninsula, is intersected by numerous greenstone dykes, which generally run from N. by W. to S. by E. These dykes are of great importance to the agriculture of the country, as the granitic soil is extremely thin and poor, except in the valleys, where the clay formed by the decomposed felspar accumulates, and bears fine crops of rice, for which water is collected in tanks, often in a great measure formed of natural mounds of rounded or angular fragments of greenstone, which is little subject to decomposition. At Jakrampilly, there is a remarkable dyke of this kind, which can be traced for several miles by a series of tanks on one side of it: it is also remarkable in exhibiting, where it rises into a small hill near the village, the gradual transition of the granite into the greenstone, and in the latter, having a tendency to split into regular forms. When once a fissure, however small, is formed, the rain washes a gradually increasing portion of lime and other soluble parts of its surface into the interstices, until the masses are separated, in which the alterations of temperature probably assist. It is difficult to account for the manner in which the greenstone passes into granite in this instance; but it is evident, that it has been raised by the granite above the continuation of the dyke at either end of the hill. I have been more minute in the description of the hill of Nugger, principally with the view of affording some information relative to the distinction of the basalt ridges, which have burst through the granite of the Deccan, from the greenstone dykes, which are of such frequent occurrence. The presence of olivine; the soft wacke in which the globular basalt is embedded; the less crystalline structure; the passage into amygdaloid containing calcedonies, zeolites, &c. and the granite in the neighbourhood of all the *smaller* masses of basalt, differing little from that at a distance, may perhaps be sufficient to distinguish these important rocks from each other. The separation of the different ingredients of the granite into large crystals, and the insulated masses of greenstone found in it near the dykes, prove, that the rock had been softened by heat; but judging from the appearance and great length of many of these dykes, I do not think that they were of contemporaneous formation with the rock through which they pass. Near one of these, at Secunderabad, a smooth, wall-like dyke of white granite passes through the sienite.

At Balcondah, 21 miles north of Jakrampilly, these dykes occur on the large scale, and the granite is much separated into its constituent parts, the felspar being of a fine red colour. Nine miles further north, in the bed of the Godavery, the felspar is of a still more beautiful red colour; but good specimens could not be removed. Veins of quartz also occur at Balcondah, with turbid milky spots, as if altered by heat, and large imbedded crystals, (No. 42.)

** Síchel Hills; locally known as the Nírmul range.*

Nírmul is surrounded by granite hills, containing much hornblende and a little schorl; and the summits of some of them appear to resemble the greenstone of Jakrampilly, but they were not examined. After passing some small ranges of hills, the ascent of the Nírmul chain commences five or six miles north of the town, and the road continues amongst lofty hills covered with forest, by a succession of ascents and descents, for 40 miles, when it descends by the Muklegandy ghat to the town of Eidlábád, nearly on the level of the flat country of Berár.

The southern ascent of Nírmul ghat, is the most deep and difficult, the hills not rising in a series of terraces as they do to the north; yet it is not easy to ascertain the precise direction of the part of the hill range over which this pass leads, on account of the projecting spurs and low hills at their base, the thick forest with which it is covered, and from its having something of a curved form. The general direction is from W. N. W. to E. S. E., which corresponds with that of the Síchíl range, to which these hills belong, and which extends from the great lake water of Lonar to the neighbourhood of Mungapett, where the silicious fossil wood (marked "fossil wood," Mungapett), was found in 1828. On approaching the hills, the granite is observed to become soft, and to decompose rapidly. In the bed of a stream it has a remarkable concentric appearance, which was also observed in the centre of the hills south of Thitnoor, where it is covered by trap, on which fossils were found. No schistose rock was found here, but 20 miles to the east of Nírmul, and a few miles south of the mountains, hornblende slate occurs on the granite, and along with it the magnetic iron ore described by Voysey in the Journal of the Asiatic Society, vol. II. It is not a sand, as might be inferred from his description; but the grains of iron are either mixed with the hornblende or occur in a sandstone-looking gneiss, from which the hornblende had disappeared. Specimens of the rock, which I saw dug up, and of the sand formed by pounding it on protruding masses of granite, are forwarded. The softer pieces were at once reduced to powder, while the harder were first roasted; and the one was then easily separated by washing in small shelving hollows dug in the clay. It is then melted, and its quality said to be improved by using teak branches: the iron is soft, but part is used in the mixture from which wootz steel is formed. The strata of the schists have been broken and elevated, but the dip and direction are in no two places the same. Here also, the granite was seen, in the bed of a torrent, in thin concentric scales, not unlike the extremities of petrified trees, caused by the unequal waste of the component parts, the quartz projecting unaltered.

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* Also called "Shesha."

On approaching the hills, the soil gradually became black, with scattered fragments of calcedony; and at the first part of the ascent, which is for some distance very gradual, a singular fragment (No. 49) of semi-vitrified matter was met with, containing small white crystals of felspar. It could not be distinguished from a piece of granite fused in a steel furnace, with which it was compared by Dr. Voysey. At the same place there were fragments so much like iron slag, that till I found them in a large mass resembling a dyke, I supposed that they were the product of a furnace, (No. 49.) The granite continues the surface rock a little further, passing into a black hard basalt, intermixed with many white spots, apparently of felspar; but I saw none of them rounded or distinctly crystallized, forming amygdaloid or greenstone porphyry, such as occur at the lower part of the pass leading to Eidlábad. On ascending the last part of the base of the hills, the surface was strewed with calcedonies, quartz, (No. 52) and other minerals of the same family, and amongst them, a few fragments of a softish white clayey and silicious stone, containing small shells of fresh water families. The trap then became softer, more vesicular with calcedonies, zoolites, &c. imbedded, and the surface covered with tabular crystals of the same kind as those so remarkable in the Poonah trap rocks; and latterly concentric, the external layers decomposing, and the nucleus lying in a soft greenish wacke. I spent several hours in ascending the highest points of the range, but was unable to discover any beds of fossil shells; large blocks of quartz were, however, observed, with a singularly angular surface, and sometimes with fine capillary crystals, much of which was found with the fossil fragments; and afterwards, in the same position and partaking of the characters of the fossiliferous masses found in sitû. These blocks were seen extending along the steep face of the hill at the same level as if they had been forced out of the mountain, or rather, as if the basalt, when erupted, had covered, and partially melted the bed on which it lay, and thus caused the singular appearance of those blocks. The highest summit east of the pass is caped by some horizontal strata, having some resemblance to sandstone that had been altered and blackened by heat; what its real nature was, I could not determine.

The hills, for 44 miles by the road, are arranged in terraces with steep sides and flat summits, rising now and then into conical elevations, with rounded or flat tops, and inclosing narrow valleys, abounding in streams, or small table lands with water every where near the surface. On some of the ridges, the globular basalt becomes columnar, near which no trace of fossils, and hardly any calcedonies have been found. A thick wood and grass jungle, composed of very different plants from those most common on the granite hills, cover the whole tract, and render it unhealthy for the greater part of the year. In a deep valley, about the middle of the hills, where the Kurm or Kurrum river passes through them, the basalt is seen to rest on friable granite, (as near Nírmul to the south and Eidlábad to the north, and at one or two other places,) and a level plain of considerable extent and deep black colour extends to Etchoda to the neighbourhood of the shelly rock. The fossils were first found at Munoor, and between that village and Thitnoor, which is near the top of the Maklegandy ghaut. The most remarkable were found in the beautiful grey chert*, which either projects from the basalt in which it is imbedded, or rests in large blocks on the surface. The side on which they rest is remarkably smooth and even, while the others are rough and covered with bivalve shells of great size, and some of them having the epidermis still entire, resembling a recent bed of shells on the sea shore. A few univalves also occur converted into flint, and it is remarkable, that one small bivalve, thus altered, retains its colours. The masses are evidently in sitû, and have probably been consolidated by the basalt, with which they are surrounded, or on which they rest. Some specimens exhibit a mixture of sand and mud, merely slightly agglutinated and intermixed with fragments of shells; the greater part is converted into chert spotted with fragments, or containing the shells in a perfect state; in other places, the materials have arranged themselves into an enamel-like substance around irregular cavities containing fine crystals of purplish quartz, and in one specimen a formation of calcspar has taken place. Throughout the rock perfect bivalve shells, both closed or open, occur in the situation in which they had lived and been entombed. The most perfect are closed, and some of them are easily separated from the rock to which they are slightly united at a few points only; they are filled with the stone, mixed with fragments of minute shells, and some are entirely converted into chert, which retains the form even of the ligaments so completely as almost to lead one to expect to be able to open them.

Between Munoor and Thitnoor, masses of red chert project from amongst the basalt, and contain various shells, mostly univalves of small size, and some of them evidently belonging to fresh water genera. Near to these many fragments of different kinds were found lying loose on the surface, and abounding in shells of various families. (See specimens.) Those in the green crystalline mass, resembling an ore of copper, were in many instances converted into quartz crystals, retaining the perfect form of the shells; one of these of exquisite beauty, which has been unfortunately broken, was found in the interior of a larger one: others were imbedded in a tough white clay rock, so soft as to soil the fingers. The greatest part consisted of a siliceous rock, partly converted into a black bituminous flint, or a coarse quartz, partially altered into calcedony, into which the majority of the shells were converted. Some, on the contrary, retained the structure of the shell unaltered, and effervesced with acids.

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* See labels on specimens.

Amongst these, the fragments containing the fossil seeds of chara, associated with fresh-water shells, were found. The gyrgonites were not observed at the time the specimen was found, but the rock to which it belonged could not be far distant, as the shells are of the same species as in other specimens, having a similar mineralogical structure. In other fragments, remains of grasses appearing half consumed were seen; and in the large protruding mass of red chert, containing shells converted into calcedony, I discovered what I take to be the tooth of an herbivorous quadruped. A few of the shells I believe to be marine, and at the distance of half a mile, the principal masses of grey chert, containing the large marine shells, were found.

On descending towards Thitnoor, granite is seen at one place, and above, much quartz, having a slag-like surface of the kind seen above Nírmul occurs. A few specimens of black chert, with shells, were picked up in the bed of a nulla at Thitnoor, where it was also found in sitû. A loose piece of reddish and green flint, with shells, was also met with in a ravine three miles further north. Much lime and kankar was here mixed with the black soil, or was deposited in the water-courses; the greater part probably derived from the decomposed basalt, or from such layers of a soft white limestone, as were found between the laminæ of basalt, in digging pits to obtain water for the troops, when encamped at Etchoda. A compact stratified limestone, however, occurs in the vicinity.

The pass from Thitnoor, called the Muklegandy ghat, is formed of several terraces, of which three only are remarkable, and a steep descent between each. The surface rock of the second terrace is a rough, white limestone, which appeared to be consolidated in nodules, until it was broken, and found to consist of a great variety of shells, many of great size, but difficult to remove entire, forming a rock of a crystalline texture. The strata are horizontal, and in one place, where it is cut through by a torrent, the rock is 12 feet thick, and *is seen to* *rest directly on granite of* a reddish color. The shells are of very various forms : several belong to the genus Ostrea of Linnæus ; one very perfect Cardia was entire, both valves being connected, and one fragment, of a very large shell, has the water-worn appearance often seen on the sea-shore. The edges of the large shells are harder than the rest of the rock, and stand out from it, which has led the natives to compare its surface to the impression left by the feet of sheep, and to name it "Bakrí ke páun ká patthar." Over the surface, many fragments of basalt, calcedonies, &c. are scattered, derived from a lofty spur of the higher point of the mountain, which rises precipitously from the terrace within a few hundred feet of the fossil strata. A very remarkable mass of soft peperino, resembling ashes, of which a specimen is forwarded, seemed to proceed from the limestone, where it begins to be lost amongst the debris of the mountain ; and amongst the loose fragments, were some very tough clayey stones, having the forms of small univalve shells adhering and embedded.

The facts above described, and the nature of the different fossil beds, more especially this great accumulation of marine shells *resting immediately on granite,* and the fossil seeds of charæ, now perhaps first found in India, leave no doubt on my mind, that this wild mountain country, now covered with a dense forest, had once been the bed of an inland sea or great estuary, on whose shore the charæ and associated fresh-water shells had flourished.

On descending the pass towards Eidlábád, the rock changes to amygdaloidal trap, with occasional masses of greenstone porphyry, having large crystals of felspar imbedded. The opake milk-white quartz, and the beautiful white porous crystalline mineral, which accompany the fossils, were found here, and were not met with elsewhere. At the foot of the pass, granite re-appears, and protrudes in great masses from the soil, for about four miles on either side of the town of Eidlábád*.

Basaltic Tract between Eidlábád and Nágpur.

The greater variety of rocks that occur between Eidlábád and Nágpur, and the interesting appearances they exhibit, will render it necessary to enter somewhat more into detail in describing the localities whence the specimens were collected ; so as to afford the means of determining their relations to each other, and to the fossil deposits already described ; as well as to the great western trap formation, and the stratified rocks to the north and south.

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* The localities of some other minerals found in the Nírmul hills are marked on the specimens. The blood-red chert found in the valley of Ankní is remarkable.

The bed of the small river of Eidlábád (see map) is covered by numerous fragments of the argillaceous blue limestone, so well known as underlying the diamond breccia in the Cuddapah district south of the *Kistnah.* Three miles higher up, the stream runs over the slightly inclined strata of a fine white sandstone, having some quartz fragments imbedded, rising towards some lofty ranges of trap formation to the east, (the Manik-gurh hills*,) and are some places converted into a quartz-like mass, as is seen in some of the Cuddapah sandstones. It probably rests on the blue limestone, which is seen to pass into a soft bluish or reddish clayslate in the bank of a stream a few miles north.

About 10 miles N. of Eidlábád, the limestone is found on the surface, forming smooth slabs, having much calcareous spar and rock crystal between the strata, and in their veins through the rock, and in the course of the natural figures, numerous small round perforations are arranged in lines, and occasionally filled with soft calcareous matter. On a rising ground south of Zeynád, the marble had occasionally a dip of 40 degrees; but for the most part it was nearly horizontal, and the direction of the dip was quite irregular. In the nala of Zeynád, which runs over limestone, there is much tuff, having small pieces of the limestone imbedded, and evidently formed from the water of the stream (specimens No. 85); a similar formation is, however, found in a few places on the high level ground to the S. W. To the east of the village a gently rising ground extends nearly N. E. and S. W. for about three miles, and terminates in a small hill, which rises rather abruptly. The slope is formed of nearly horizontal slabs of marble, the edges of the strata being exposed by the gradual rise of the surface. In following the ridge to within half a mile of the little hill to which it rises, a singular appearance presented itself: a dyke of perfectly vertical stratification, about three feet in thickness, projects two feet from the general surface; its exterior is singularly irregular and altered, the constituents of the rock being formed into crystalline or flint-like minerals of lime, argil, or silex, while the internal structure retains the characters of the blue limestone. On following this natural wall for about half a mile, it is concealed by globular basalt, which has burst through the strata, and in forming the termination of the little ridge, has covered the surrounding limestone, of which a portion has been so singularly displaced. The basalt is vesicular, and resembles much of that found in the Nírmul hills. No fossils were found here; but in the ascent from the second terrace of the Muklegandy ghát, where the great bed of marine shells was incumbent on granite, the same limestone was seen in sitû, greatly broken up by the eruption of the precipitous trap ridge, on which it was seen. The thickness of the grass and wood jungle prevented its being traced with sufficient accuracy. Fragments of the same rock were also seen at Thitnoor; and a very similar rock was observed in horizontal strata at Muneer, not far from some great blocks, containing marine fossils, in one specimen of which small univalve shells were found. But as this locality was only examined by torch light, I could form no judgment as to the formation being the same; although the total absence of fossils in the blue limestone, over extensive tracts in which I have searched for them, incline me to think that they are different.

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* The Manik-gurh hills run from N. by E. to S. by W. almost at right angles to the Nírmul range.

The relative age of the blue limestone and great trap formation, to which these hills belong, being ascertained by these and other facts; it may be hoped, that a careful comparison of the fossils will assist in determining the period to which other rocks occurring to the north and south belong. I have not been able to detect amongst them any of the Himálaya fossils; but some fragments found in indurated clay at Jirpoh, near the hot springs in the valley of the Nerbada, and in a specimen from the Gawilgurh fossil rock, described by Dr. Voysey in the 18th vol. of the As. Res. appear to belong to some of the same shells.

The march to the Payngunga river is over a flat country of black soil, modified in some places by a mixture of earth derived from slate clay, which appears occasionally at the surface, and of the same kind as that found below the limestone of Cuddapah, or which takes its place under the diamond breccia of Banganapilly. Jaspers, striped red and white, are found in the black soil. Scattered over this extensive plain are a number of small conical hillocks of white kankar, apparently formed by springs issuing from the centre, and now dried up: in some of them the apex is a little depressed. Several long straight ranges are seen at a distance, generally flat on the summits, but occasionally rising into cones, with a lengthened base, corresponding to the direction of the hills. About half up the greatest height a remarkable line extends all along, on which the summits appear to rise as on a terrace, or like the parallel roads of Glen Roy.

The pebbles of the Payngunga are principally calcedonies of a reddish color and the blue limestone. No. 93 is a specimen of the calcareous sandy tuff from the banks of this fine river; it is found as high as 25 feet above the water at the fort; and is always horizontal, with black soil between the layers, which are from an inch to three feet thick. The surface is irregular, but seldom or ever shoots into branches like the tuffa of the Godavery, and holes occasionally occur in the layers, from a deficiency of lime; in other places, it projects three or four feet, in consequence of the soft soil being washed away. In one of the specimens, numerous recent shells are imbedded, which correspond in situation to a layer of these left in the sand by the last fall of the river; and it is evident, that the tuffa is formed from the infiltration of the lime with which the black soil and the water of the river abound, into layers of sand. In all these rivers, and in the stream of Bibbery and others running into the Godavery above Badrachellam, beds of limestone conglomerate, cementing agates and calcedonies, are continually forming.

The country between the Payngunga and Kair *has at all seasons* many springs and streams of pure water; which give a lively and beautiful green to the vegetation, when the surrounding country is burned up by the scorching heats of May*. The first of these streams is at Lingtee, the water of which is loaded with lime, which it deposits on its bed in a thick incrustation of tuff. Loose pieces of branches, petrified by lime, were found on the banks, and a wall of kankar six feet high in contact with No. 95, seemed to have been formed from a spring which had gushed from a fissure in the blue limestone, which is here the surface rock, and rests on a reddish, very friable slate clay, as is seen in a section a mile further down the stream. The black flint, No. 96, resembling anthracite, was found higher up. This stream, which, in the driest weather, has sufficient water to drive a mill, is said to have its source about six miles distant in a low range of hills, over which the road passes more to the east, a little to the north of Urjuna, and three and a half miles from Lingtee. At this village, a small stream takes its rise in a hot spring, whose temperature, as it gushes from beneath the wall of a half ruined reservoir was, in December, 1833, almost 87°. Copious springs also rise in the bed of the little stream; and globules of gas are extricated from round holes in the mud; but on endeavouring to collect a quantity, it was found that there were considerable and irregular intervals between each jet of air, nor did it always issue from the same place. The springs rise through the blue limestone so often mentioned, which, in a section in the north bank, is seen to have been raised by some violent forces, in a very singular manner, so as to form a series of irregular piked gothic arches, overlaid by partially broken but horizontal strata. The spaces within the arches are filled with fragments of the same rock, all evidently forced from below. The bed of the stream has a covering of sand, which, some way below, is agglutinated by lime into a tolerably hard rock. The sand is derived from a quartoze sandstone, which crops out in two or three places from the ascent south of the spring. The strata are not horizontal, but neither the dip nor line of bearing could be observed.

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* The same was observed of the beautiful stream at Bibbery, in the month of May, 1828, and inclines me to think, that it derives its source in springs like those of Kair, to be presently described. It rises in the Nirmul range.

North of Urjuna the rock is concealed by the soil as far as the Pindee ghat, nearly a mile distant, which passes over the steep low range, in which the Lingtee nulla rises. Its top is rounded, but on either hand, several conical summits are seen outlying from the range, which extends for some way from N. W. to S. E. On leaving the plain of Urjuna, the blue limestone disappears, and the hill is found to be composed of the usual black concentric basalt, the nuclei of which are exceedingly hard, and contain much olivine : they are imbedded in a soft grey or greenish wacken. I was surprised to find the road and a ravine descending from the hill strewed with the limestone I had left below, and did not quite credit the guide, who pointed to the top of the hill as the locality from which they came. I, however, soon came to it in sitû, in its characteristic large smooth slabs, which render it so difficult to pass on horseback. They were observed to be slightly convex upwards, to be very much fissured in various directions, and if taken in the mass, to have a slight anticlinal dip, although on the top the slabs were horizontal and several places remarkably altered, as if they had been half fused ; the argillaceous and siliceous matters having arranged themselves into beautiful streaks of a pale blue enamel, passing into calcedony, or crystallized in minute prisms. Some parts of these strata had acquired a deep black color, and a flinty hardness. On descending the hill on the opposite side, the same appearances presented themselves, and left no doubt of the limestone having been raised from its connections by the intrusion of the basalt, which had slightly bent the strata, and in doing so, had caused the numerous fissures, and the alteration of structure. North of the Pindee ghat, there are a number of very low rising grounds, flat on the top, and composed of black globular trap rocks : and on the valleys, many large coarse masses of calcedony are scattered ; of which, on a slight examination, I saw none in the hills. Near this, the limestone, No. 97, was found in the bed of a nulla. A little further on, there are two very black conical hills of trap, and at their feet, great fragments of rock crystal, but of no beauty, and having cavities lined with calcedony. From hence to Kair, the country is more level, rising however a little, to the right of the road ; and four miles from the Pindee ghat, and the same distance from Kair, I found the sandstone, Nos. 99 and 100. It was only seen in a small nulla where its strata appeared to be horizontal, and was white, red, or of a fine yellow, easily decomposed, and having small metallic veins passing through its substance, No. 100, and in one or two places, passed into a breccia, cemented by lime. No other rock is found at a higher level. I had been induced to examine this extensive slope, as the occurrence of the blue limestone suggested the probability of a sandstone or breccia being found above it, as at Cuddapah, before I discovered the sandstone at Urjuna, and near Eidlábád; I was therefore much gratified by finding it, although different in mineralogical characters. The country did not afford any section, but the sandstone probably rests on the blue limestone, which is met with at a lower level, two miles to the north-east. A mile and a half south of Kair*, the road crosses a small river, where there are some masses of travertine several yards square, which have been carried down by the stream: they are entirely composed of petrified branches and leaves, with a cement in some parts of considerable thickness, and more or less crystalline, or resembling kankar.

The stream rises near the town in copious hot springs, whose water is considered to be exceedingly pure and delicious; but when taken from one of the springs, where it can be directly received, was found to be acid to the taste, and, on boiling, deposited lime, which the carbonic acid had held in solution. Bubbles of gas are also extricated with the water, from one of the springs. The lime separates in its course, giving a whitish appearance to the water of the pools, while it sparkles near the springs and in the rapids, as was the case also at Lingtí. The temperature of the spring, in 1831 and 1833, was 87° and is the same in May, June, and December; but the difference to the feelings, according to the temperature of the air, is so great, as to have led to the belief that it is cold in the day and hot at night; the thermometer, however, showed that it was the same at 3 P. M. and 5 A. M. of the 5th June, when that of the air was 100° and 81°. The principal spring rises at the root of a great Banian tree below the pagoda, and is stated by the devotees to flow in the same profusion the whole year, which they account for by saying that it flows from the Ganges at Benares. This and other springs form a stream, that increases as its course is followed downwards, notwithstanding that much is directed to gardens, and a fine sheet of paddy in the bend of the river thus formed. About half a mile below the spring, the first formation of rock is found crossing the stream like a dyke, but of considerable breadth; others more remarkable are found lower down, and after a winding course of 2½ miles, it seems to cease. The congeries of branches, roots, and even trees, sometimes hollow, and always in concentric rings of deposit, forms a beautiful sight when in masses of several tons weight. The strata were seen in one place to be 12 feet thick, and to rest on the common black alluvial soil ; near this, it had filled the original bed of the stream, and forced it to find another channel : and in two places, a fall of three or four feet, forming a pretty cascade, seemed to be occasioned by the growth of the rock, and the wearing away of the channel below. The deposit often conceals the remains of plants, with a smooth coating of considerable thickness and firmness, frequently rounded in irregular sections of large circles ; in others, in nodulous forms of great beauty, covering over the extremities of the smaller or larger branches, and occasionally preserving the wood in an hermetically-sealed cavity. The roots of the Banian now and then pass into the empty tubes, as if they were the mould on which they are formed ; others probably form on the weeds, which flourish in the wildest luxuriance along the banks : one of these I found to be 24 feet in height. Recent shells, such as now inhabit the stream, were found in many places enveloped in the stone. One fine specimen of *lymnæa* was attached to the side of the rock, as if it had been arrested there by the deposit of stone around it, and which has taken its shape ; its fine surface, where it adhered, being that of the fresh shell ; while the coating exhibited the color and fracture of the tuffa of the hillocks south of the Payngunga, and others exactly similar, near the town of Kair. Roots and branches were seen to lie in the deep water without a coating of stone ; but the series of observations so accurately described by Mr. LYELL was completed, by finding where the stream fell over some rocks, a plant still living, whose roots were thickly interwoven, and the leaves on a level, and just above the water, cemented into a mass of firm white tuffa. (Specimens of the water and tuffa were formerly sent.)

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* This small town must not be confounded with a large place of the same name on the Godavery.

The spray seemed, therefore, to produce the deposit more quickly ; but specimens of moss growing below the water were also converted into sharp brittle spiculæ.

Below, some blocks were softened, and as if in part redissolved. Amongst the petrified plants, one tree 1½ foot in diameter was seen : and also a few leaves ; but these were rare, I suppose from their rapid decay and smooth surface ; one of them seemed to belong to a species of lotus seen in a pool above, and another seemed to be the leaf of aloe. In some places the tuffa was sandy, and in one or two slightly tinged with iron ; some of it had a fine crystalline appearance, and considerable hardness ; while other specimens could not be distinguished from kankar. A tendency to the formation of a bluish white scum was observed on the surface of the still water, both here and at Lingtee : a slight smell resembling sulphur was also occasionally perceived ; and at the latter, our people procured water of a very offensive taste, although perfectly clear, from a well which I did not see.

The water abounds with animal life, and the banks are covered with a profuse vegetation, amongst which many fine insects were seen ; and in the hot season, all forms of life seem to gather round this oasis in the black burned-up country around. The banks and water affording so much food, vast numbers of birds of different species, game, doves, kings-fishers, herons, &c. are collected together, whose habits a naturalist might spend months in observing, without exhausting the field of inquiry.

All the springs seemed to be equally loaded with calcareous matter, and similar formations by springs now closed up are seen on a rising ground down the river. Here too, the globular trap again appeared on the surface in several places, of small extent ; one was a little to the west of the greatest formation of travertine, and another below the ford where the hard nuclei were surrounded by layers of a grey friable wacke like that of the Nírmul hills, and are curiously divided into compartments by tuffaceous partitions. Near to this, the blue limestone is again found in extensive slabs, slightly raised from its horizontal position ; but as usual in no regular direction, the strata occasionally meeting each other at an obtuse angle. The same remark applies to the rock as seen to the north of the springs on the road to Won, and to almost every other place where I have met with it. Near the last mentioned bed of basalt, some irregularly inclined strata of blue rock, having a granular sandstone-like aspect, were seen, and at no great distance, large loose masses of vesicular scoriæ were found, (specimens Nos. 109, 115.)

But the most interesting appearances are seen, in a small irregular rising ground, above the pagoda at the principal spring, which will be best understood by an inspection of the specimens 104. The basis of the rock is a tough white limestone, projecting from the gentle rising ground in very irregular masses, passing into curious and beautiful jasperous minerals, often coated with minute rock and other crystals ; and the whole is perforated by large cavities, and even holes, evidently formed when the rock had been erupted in a semifluid state. Much tuffa is associated with these altered rocks, filling up many of the cavities, and having various minerals imbedded. I believe that few places exhibit so many of the most interesting effects of volcanic action, as the small district around Kair ; more especially in altering a stratified rock of apparently uniform structure, so as to form a great variety of minerals*. A good deal of sandstone has been used in the old buildings, which the inhabitants stated to be brought from Sacra, five miles to the west.

To the north of Kair, the limestone resumes its blue color; the soil is black, and a little further on, mixed with calcedonies, &c. In the nulla at Won, quartz sand, sandstone, and a mineral resembling pudding-stone were picked up; and at the foot of the hill, the remarkable vegetable fossil figured in the fifth number of the Madras Journal, and now deposited in the museum of the Bengal Society. The small hill of Won is composed of sandstone of different colors, red, white, and yellow, and waved lines of a black color from disseminated iron, pass through it in various directions—the composition of which is the same as that in which the fossil is contained, and No. 100, from between Urjuna and Kair. The strata have been elevated by the convulsions to which the rest of the district has been subjected, and have a dip from the apex of the hill, varying from 35 to 55 degrees: their direction on the southern face of the hill, is nearly from E. to W., but to the west they turn off towards the rising ground on which the town is situated, the line of bearing of the strata being from S. E. to N. W. The swell of the hill extends some way to the east, but the country is on the whole level. This sandstone is also found to the eastward in the basin of the Wurdah and Godavery, beyond Chanda.

Sand derived from these rocks forms the soil for two miles north of Won: between that and the Wurdah, it consists of the basaltic black soil, and the gravel of that river is composed of calcedonies, agates, &c. of which a calcareous conglomerate, in horizontal strata, two or three feet thick, has been formed, No. 123.

At Waronah, white sandstone and a yellow slate, apparently belonging to the clay slate formation to which VOYSEY refers the blue limestone, is used in building; and one obtained from a hill five miles distant, which I had not time to visit. Most of the pagodas between Hingan ghat and Chanda are built of the same materials. Between Waronah and Chiknee the country is level, well cultivated, and the water within a few feet of the surface; much fever prevails after the rains, although there is no wood or marsh. Basalt protrudes from the level soil, and near it, the bed of a small nulla displays strangely altered strata of the red slate clay, seen at Lingtee, which is broken up, and intermixed with crystalline nodules and layers of calcareous spar, having a red clay in the interstices. The specimen (No. R. 5) gives an imperfect idea of the singular appearance of this rock. At Dyeghám, two miles further north, and about the same distance south from Chiknee, it is seen dipping to the west of south at a considerable angle, is much fissured, and is reticulated with beautiful veins of calcareous spar, filling up the vertical interstices, which vary from a line to half an inch in breadth ; they intersect each other in all directions without disturbance, and were evidently formed at one time.

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* In some specimens, the surface has the appearance of a semifused brick, which had assumed something of a regular arrangement, whilst the centre is composed of the blue limestone little altered.

To the east of this, and of the village of Chiknee, there is a very gentle rise of the country, and concentric basalt and great round trap boulders are seen wherever the soil has been removed. On this are found numerous great blocks of indurated clay, of remarkable hardness, and exhibiting all the varieties of that mineral, of flinty slate, of compact schist, and of semi-opal*. Many of these masses are also found imbedded in the basalt ; and on a very careful examination, the inference could not be avoided, that they owed their different appearances to the greater or less heat to which they had been exposed. Most of them are full of large and small univalve shells, many of which are of fresh-water genera. Many of the shells are changed into opal, others are covered, or their shape taken and preserved by quartz crystals ; while the shells of a few can be separated unaltered, and effervesce with aids. The spines of the small shells are often insulated in cavities in the rock, and their crystalline surface is often very beautiful, when examined with the microscope. Some vertebræ and the head of a fish were met with ; but from the great toughness of the rock, part only could be broken off, and a portion of the same block was converted into a red flint, with shells changed into opal. A large loose block of a slaty structure was found near this, containing fragments of very large bivalve shells of great thickness, along with wood converted into a black flint, intersected by fine veins of a light purple opal ; and other bivalves which had been crushed together, were found in a flinty state on the upper part of the rising ground. I do not think that I go beyond the limits of correct inference, in supposing these shells to have lived in a mud formed from the decomposition of the clay-slate found in the neighbourhood, and through which the trap is seen to have burst†.

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* Loose specimens of this rock was seen by Mr. W. Geddes, Surgeon of the Madras European Regiment, in 1829, who directed my attention to ascertain their position.

† Shells were first found here by Mr. W. Geddes, late of the Madras Medical Establishment.

The country to Naugri continues to be composed of basalt, which is in some places tabular, with green earth between the laminæ; and the soil is covered with calcedonies, ribbon and pudding stone, jaspers, resembling those found in the Nírmul hills, to which the whole character of the formation remarkably assimilates, and leaves no doubt of their belonging to one great period of protrusive violence.

At Naugri, fossils like those of Chiknee are formed; and with the conical masses of calcedony, having a smooth flat base of cachelong, the centre being filled with quartz crystals and calc spar; which were afterwards seen in sitû at Hingan ghat, inserted between the globular basalt with the apex downwards, the peculiar appearance of the base being perhaps caused by slow cooling.

At Hingan ghat, a number of blocks, loose, of a black and red chert, containing silicified branches of dicotolydonous trees, and a very perfect portion of a palm (date?) tree were discovered: and the same kind of rock, but without fossils, protruded from the basalt a little below Colonel Lambton's tomb. The basalt was globular, but seems to have had a tendency to form five or six-sided prisms. The rest of the route to Nágpoor is over a level country, from which a few insulated trap hills rise abruptly, on whose summits basaltic columns are occasionally met with. On the south side of the small range of hills near the city, these columns are very regular, and inclined to the south, at an angle of 45°, in consequence of which many of them have fallen. The flat top of the hill forms a pavement of the ends of similar columns perpendicular to the horizon. The round flat topped hill of Sitabuldee, which is accurately described by Voysey in the 18th volume of the As. Rs. is separated a few hundred yards from the extremity of this range, and rests on a decomposing granitic rock; its great and irregular masses show a similar tendency to crystalline arrangement, and thin sheets of calcedony are found in the joints.

To connect these observations with those published in the As. Researches and Journal, on the countries south of the Nerbada, it is necessary to mention, that at the cantonment of Kampty, eight miles north of Nágpoor, the sandstone is met with in the north bank of the Kanan river; and a mile higher up, the granite has been forced through the strata, bending or converting them into quartz rock. The crystals of felspar and plates of mica are remarkably large, and mica slate is seen in a quarry a few hundred yards distant. Beyond this are some small hills of upraised gneiss; near to which a conical hill of curiously altered rock, resembling that above the hot springs of Kair, has burst through a limestone, which it appears to have converted into a fine crystalline bed, like that found in the primitive districts of Scotland.